Driving and Elderly Primes in a

Simulated Driving Environment

by

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ABSTRACT

Research studies have demonstrated that stereotypes can elicit a priming response. An experiment was conducted to test the effects of priming elderly and young stereotypes on driving behavior. Participants drove in a driving simulator while navigating through two driving routes. Participants were guided by a neutral voice similar to “Siri” that informed them where to turn. Each route primed the participants with names that were deemed “old” or “young” as determined by a survey. The experiment yielded slower driving speeds in the elderly condition than in the young consistent with previous research regarding elderly stereotypes (Bargh et al, 1996; Branaghan and Gray, 2010; Taylor, 2010; Foster, 2012). These findings extend research on priming and behaviors elicited by participants in a simulated driving environment.

DEDICATION

To my future husband, John. Thank you for everything. To my mom, thank you for your never-ending support.

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INTRODUCTION

Social and experimental psychology extensively studies what exactly motivates human behavior. Of primary concern, is whether human behavior is comprised of conscious choices, automatic processes or a combination of both. Evidence suggests that people are unaware of many stimuli from the surrounding environment (Wegner, 2003). These environmental stimuli may lead people to direct their actions without conscious awareness (Branaghan & Gray, 2010). For example, mimicry occurs unintentionally, without awareness even among strangers. Chartrand and Bargh (1999) asked a confederate to either shake their foot or rub their nose while completing a task with a participant. The participants shook their foot more often in the foot shaking condition than in the nose rub condition. Conversely, participants rubbed their nose more often in the nose rubbing condition. Moreover, the participants seemed unaware that their behavior had been affected in any way. Provine (1986) had thirty-two participants watch a video with actors that either yawned or smiled. Results showed that participants who viewed actors in the yawn condition yawned more than twice as many times as those than in the (control) smile condition. Following the experiment, participants were asked whether or not anything stood out to them about the actors. One participant mentioned that one actor made hand motions when speaking and two other participants noted a actor's posture. However, no one mentioned noticing the yawning or the smiling. Further, when asked about the confederate's mannerisms no one stated that they noticed the mannerisms. Additionally suggesting that they were not consciously imitating the actor and they were not aware of the mannerisms in the first place.

Priming

Priming refers to the temporary internal activation of response tendencies. Priming research techniques examine the ways that internal mental states mediate, in a passive or hidden manner, the effects of the social environment on psychological processes and responses. Priming studies examine effects of the current situational context, and how these environmental features cause an individual to think, feel and behave differently (Lashley, 1951; Chartrand & Bargh, 1999; Bargh & Chartrand, 2000).

Priming with word associations and sentence scrambles has been used in recent psychology studies with success. The participants are led to believe they are participating in a language exercise, which allows for the primed trait to be tested. For example, Bargh, Chen and Burrows (1996) proposed that social behavior is often triggered automatically by the mere presence of situational features. They conducted an experiment in which 34 college students were primed with words associated with elderly people or a control condition, which did not include elderly associations. The real experimental measure began when participants were leaving the experiment room and were timed on how long it took them to walk from the hallway to the elevator to exit the building. The hypothesis was that participants in the elderly prime condition would walk slower to the elevator than the control condition consistent with the “slow” elderly stereotypes. The participants in the elderly condition did walk slower and took longer to arrive at the elevator than those in the control condition. When the participants were debriefed after their arrival at the elevator, no participant believed the word associations elicited a change in their behavior (Bargh et al., 1996). These findings demonstrate unconscious behavioral change in participants without conscious awareness.

Human Automaticity

Human automaticity is the ability to do things without occupying the mind with low-level details. Skilled behavior, for example riding a bicycle, demonstrates human automaticity. As noted by Foster (2012), when beginning to ride a bicycle, one uses substantial cognitive resources. Over time, however skill develops, and riding a bicycle is done with little effort. Automatic priming was demonstrated in research done by Meyer and Schvaneveldt (1971). Twelve participants from a local high school performed a task where they decided as quickly as possible whether or not a string of letters formed an English word. The experiment used 48 pairs of associated words (e.g., bread-butter and nurse-doctor) and 48 pairs of unassociated words (e.g., bread-doctor, nurse-butter). These were formed by randomly interchanging the response terms so that there would be no obvious automatic association with any pair. In addition to these pairs were 96 pairs involving a word and a nonword. The nonwords were constructed from common words, (e.g.,replacing the “k” in the word, “mark” turns it into “marb”.). Vowels replaced vowels and consonants were used to replace consonants. All strings of words ranged from 3 to 7 letters. Results showed that words preceded by a closely related word had a quicker correct response time than those preceded by an unrelated word. Results also indicated that, if a nonword was visible before a word, a correct response was significantly faster than if the nonword followed a word. The experiment demonstrates that word associations are easy based on our images of words that go together in the world around us.

Stereotypes

A widely held but fixed and oversimplified image or idea of a particular type of person or thing is a stereotype (whether correct or incorrect). This oversimplified image can be based on factors like race, religion, ethnicity, sexual orientation, and even age (Hilton & Von Hippel, 1996;Deutsch, 2007). Studies suggest that stereotypes of the elderly exist, but it is not just one single stereotype (Rupp et. al.2005), Brewer (1981) suggests that the several stereotypes of elderly individual types vary from that of a caring grandmother, to an elder statesmen, to an isolated and inactive senior citizen. Brewer's research found that traits commonly attributed to the elderly had varying characteristics, like that of being considered "irritable", "serene", "eccentric", "naively trusting", and "suspicious" to name a few.

Further, research has shown that ageism (prejudice or discrimination based on a person's age) is prominent but difficult to detect (Levy & Banaji, 2002; Rupp et. al., 2005). Perdue and Gurtman (1988) researched the automaticity of ageism to see whether or not it was an unintentional and unconscious decision. They asked participants to answer questions based on twenty positive traits and twenty negative traits. The questions, based on the positive and negative traits asked the participant if they would associate that particular trait with themselves, with the "young" or with the "old". Results showed that more negative traits were associated with "old" and more positive traits were associated with "young". This stereotyping is found to hold through generations, often with elderly individuals believing these same stereotypes of their own peer group.

Birth names have also been found to elicit stereotyping. McDavid and Harari (1996) conducted a study of popularity based on birth names in grade-school children ranging in ages from 10 – 12 years. The children were asked to put X's by names they considered desirable, nice, if they liked the name, or didn't like the name and other questions along those same lines. The survey included the names of all the children within the class, but also names that were not represented in the class. They found a higher desirability in what were considered higher socioeconomic names. For example, the names Andrea and Tyler were considered popular among children. Further, children within the group rated names of their peers that were already considered "popular" as highly desirable. Interestingly, they also found that the social desirability values of the names rated by children outside of the classroom and unfamiliar with the settings were similar. The children had ranked names in similar order, and the same popular names e.g., Andrea and Tyler were considered highly desirable names. Unconsciously, without knowing all of the children, an individual assessment was made about the other children, based on their name, and it was rather automatic.

Driving Simulations

Driving simulations provide an experimental tool to evaluate the effects of priming. As driving becomes automatic, drivers are active in participation whether consciously or unconsciously as they guide themselves to their destination. Research on priming with elderly stereotypes in a simulated driving environment was conducted by Branaghan & Gray (2010). The experiment measured eleven participants' drive time between stop signs in a simulated driving route. Prior to driving the simulated route, the participants were primed with sentence scrambles of either an elderly stereotype or a control condition that did not include the elderly stereotypes. They found that, in the elderly condition, it took participants significantly longer to complete the simulated route, and the participants had an average slower speed between stop signs. This was consistent with the hypothesis that elderly priming temporarily changed the participant's internal response tendency without their conscious awareness. It should also be noted that the priming effect did not happen immediately, but after approximately 4 exposures to the prime. Following the fourth prime the driver's velocity changed and remianed slower throughout the rest of the simulation.

Further research conducted by Taylor (2010) had participants drive through a virtual city with guidance from a voice activation system. Twenty participants navigated through the simulated environment with voice-activated guidance with either an elderly female voice (72 years old) or a young female voice (21 years old). Taylor found that participant's drove slower in the elderly condition and drove faster in the young condition. Foster (2012) expanded on Taylor's research and used 6 voices, 3 young voices (ages 19 – 21) and 3 old voices (ages 72 – 75) to research if he could replicate Taylor's effect. Twenty-seven participants took part, and the experimental results concluded that when driving with any of the "older" voices, participants drove slower than when driving with the "younger" voices as their guide. From this previous research another research design idea formed to further explore a facet of elderly and young priming in a simulated environment.

Present Study

The current research looked to expand on the previous research in examining human behavior in a simulated driving environment. It tested priming and the automaticity of elderly and young stereotypes with the hypothesis that driving would be significantly slower when participants were primed with an elderly stereotype. Tying together the ideas of automaticity, priming and stereotypes this research sought to measure if a participant's internal activation system could be temporarily affected without their conscious awareness. Demonstrating this effect in a driving simulator would allow for a highly sensitive measure to be attained and recorded allowing several aspects to be examined in the analysis.

This research looked at the effect of driving velocity when primed with "old" and "young" names in a simulated driving environment. Birth names are a compelling measure with the findings that even young children unconsciously discriminate between names. This measure tested if a participant's behavior could change based on their belief that the street sign name is "old" or "young". The street sign names used were birth names identified by participants as "old" or "young" through a survey. Drivers were guided by a voice (similar to "Siri") through a simulated driving course. The voice told the participant which way to turn when arriving at the "old" or "young" street intersections. This experiment measured and analyzed the maximum and mean velocities of the driver in both the young and old conditions. It was predicted that the maximum velocity and mean velocity attained would be slower in the elderly condition than in the young condition. This would be consistent with previous research by Branaghan and Gray (2010), Taylor (2010) and Foster (2012).

Method

Study 1

The purpose of this study was to determine the old and young names that would be used as the street signs in Study 2.

Participants

Twenty participants were recruited from psychology courses at Arizona State University. All participated for course credit.

Procedure

To choose old and young names, an online survey was conducted to measure participants' cognitive perception of old and young names. Participants read an informed consent and then were given a link to complete an online survey through Qualtrics Survey software. The survey consisted of two questions. The first question asked the participants to rank a list of female names listed alphabetically, from 1 to 10, with 1 being the youngest and 10 being the oldest. The second question asked the participants to rank a list of male names listed alphabetically, from 1 to 10, with 1 being the youngest and 10 being the oldest. After completing the survey the answers were saved through Qualtrics. These results determined the names that were implemented into the second experiment's design.

Results

Means were examined to determine the names that were rated as the youngest and the oldest. The 3 female names deemed youngest were Ashley ($M = 2.55$, $SD = 1.42$), Tiffany ($M = 2.5$, $SD = 1.63$) and Zoe ($M = 1.9$, $SD = 0.94$) *(Table 1)*. The 3 male names ranked youngest were Chase (*M* = 1.9, *SD* = 1.04), Hunter (*M* = 2.8, *SD* = 2.91) and Travis (*M* = 2.7, *SD* = 1.27) *(Table 2)*.

The 3 female names ranked oldest were Agnes (*M* = 8.55, *SD* = 1.63), Gertrude (*M* = 9, *SD* = 1.26) and Maude (*M* = 8.4, *SD* = 2.15) *(Table 1).* The 3 male names ranked oldest were Alfred, (*M* = 8.55, *SD* = 1.73), Eugene (*M* = 8.5, *SD* = 1.42), and Milton (*M* = 8.9, *SD* = 1.88) *(Table 2)*.

Study 2

Experimental design

To test the effects of old and young names on driving behavior, a model was followed that was set forth by Taylor (2010) and Foster (2012). Taylor's experiment had participants drive through a virtual environment as they were provided navigation system directions by one of two voices (depending on condition), an elderly female voice (72 years old) and a young female voice (21 years old). Taylor used ambient traffic set at 30 mph and found the effect to be significant only when no speed feedback is provided. Foster expanded on Taylor's research examining the two conditions, but using 6 different voices. Foster used three young voices (19 – 21 years old) and three old voices (72 – 75 years old). Foster removed the ambient traffic from the simulation and kept the speed feedback hidden as well. He found that drivers drove slower in the elderly than in the young condition.

The current research extends the work of Foster (2012) and Taylor (2010) by examining the effects of old and young names on driving speed. In this work, a neutral "Siri" voice provided voice navigation directions throughout the driving simulations.

Participants drove in both the elderly and young condition for a within-subject design, and the order of presentation was counterbalanced.

Participants

Twenty-two undergraduate and graduate students (17 male and 5 female) participated for course credit. Ages ranged from 18 to 34 years old (M = 19.35, SD = .836). The drivers also had to have a valid driver's license with 20/20 or corrected vision to participate. The drivers ranged in years of driving experience from 1 year to 22 years (M = 4.4, SD = 1.04) with an average of 4.4 years of driving experience.

Apparatus

Driving simulator. The fixed-base driving simulator was composed of two main components: (a) a steering wheel mounted on a table top and pedals (Wingman Formula Force GP, Logitech™) and (b) three 19" Dell™ LCD monitors. The monitors were placed at a distance of approximately 62 cm from the steering wheel. The three monitors were positioned side-by-side to create a driving scene that subtended a total of 130° H x 30° V of visual angle. The visual scene was rendered and updated by DriveSafety™ driving simulator software running on four PC's (Dell Optiplex GX270) and updated at a rate of 60 Hz. The DriveSafety™ software can capture various driving performance elements and for this study captured velocity at 60 Hz (*Figure 1)*.

Each route included six street signs (alternating between male and female names) at which the participant was required to execute a turn. Figure 2 provides a top down image of the route for reference. A voice navigational simulation that sounded like "Siri" provided directions. In the elderly name condition, street names were derived from the three oldest female names (Agnes, Gertrude, Maude) and the three oldest male names (Alfred, Eugene, and Milton) in Study 1. In the young name condition, street names were derived from the three youngest female names (Ashley, Tiffany, and Zoe) and the three youngest male names (Chase, Hunter, and Travis).

The driving environment consisted of two-lane roads with t-intersections. A top down view of the driving simulator is provided in Figure 1. Each intersection was a t-intersection, had a stop sign and was marked with a within-intersection street sign, opposite the stop sign. Additional traffic signals and speed limit signs were eliminated from the simulation to avoid confounding variables, and help isolate the street names. The speedometer and ambient traffic were also eliminated. In each simulation, participants completed six turns separated by equal distance. Each turn was approximately half a mile apart (2,640 feet). The voice command occurred .33 miles (1,743 feet) before the stop sign and turn. Locations and distances for the stop signs and voice commands were chosen based on previous routes and measurements by Taylor (2010) and Foster (2012). The surrounding environment was similar for each intersection so that there would be no cues for the participant about their current location or the ending point within the virtual simulation.

Procedure

Participants received an informed consent and if they agreed to participate were given task instructions *(Appendix C)*. All participants completed a five-minute practice test drive. This allowed them to get comfortable with the driving simulator and controls. Following this, participants drove the first of the two simulated routes (elderly or young). The route was counterbalanced between participants. Each route took approximately five minutes and had a total of six turns to complete. Participants navigated their way through the environment from verbal navigational cues provided while driving the route. The simulation automatically ended upon completion of the sixth turn.

After completion of the first simulated route, participants were asked to count out-loud backwards from 100 to zero by fives. The reason for this was to inhibit cognitive carry over from the previous condition (elderly or young). After completing the counting exercise, participants drove the second simulation. Following completion of the second course, participants completed a brief survey *(Appendix D)*. Upon completion of the survey they were given a debriefing *(Appendix C)* that outlined the research. After finishing, credit was granted for their student course.

Post Study Survey

Following the completion of the study, participants were administered a brief survey to gather additional information. Questions included participant age, gender, how fast the participant thought they drove (in mph), years of driving experience, primary language spoken at home and major. Finally, they were asked what they thought the experiment was about.

Results

Data collected from the driving simulator was in meters per second and converted to miles per hour. All analyses mentioning velocity has been calculated in miles per hour.

Maximum velocity attained was measured starting after turn 1 and ending at turn 6 for all 22 participants. The maximum velocity was attained between each stop sign from stops 1 to 6 and then averaged for an overall participant maximum. A mixed model

ANOVA, with sex and primary language as between group variables and name condition as the within group variable, revealed a main effect of name condition. As hypothesized, participants achieved slower maximum speed in the elderly (M = 47.9, SD = 4.02) condition than in the young (M = 50.04, SD = 4.22) condition ($F(1, 18) = 7.87$, $p < .05$, $r = .55$). No other main or interaction effects reached significance (*Table 3*).

Additionally, a mixed model ANOVA was conducted, removing six participants from the maximum analyses to determine if the results would be affected. Two of the participants that were removed determined in the post study survey that names and driving were being measured in the experiment. The four were participants that stated on the post study survey that English was not their primary in home language were removed. This was to examine if the strength of the prime was greater for in-home English speakers. The mixed model ANOVA found that only condition (old or young) was significant (F (1, 15) = 6.79, $p < .05$, $r = .61$). No other effects reached significance.

Paired-samples t-tests were conducted to compare the maximum speed achieved in the young and old conditions between each pair of consecutive stop signs for all 22 participants Removing the six participants from the previous analysis did not change results significantly therefore they were included in these analyses. Data collection began after the first turn between stop sign one and two and ended once the sixth stop sign was reached prior to the final turn. Table 4 shows means for elderly and young conditions. There was no significant difference between elderly (M = 47.33, SD = 5.53) and young (M = 46.16, SD = 4.7) conditions for the road segment between stop 1 and stop 2 ($t(21)$ = 1.57, p >.05, r = .32)). There was not a difference between elderly (M = 47.30, SD = 4.84) and young (M = 48.21, SD = 7.60) conditions between stops 2 and 3 ($t(21)$ = 1.01, p

> .05, *r* = .18). This trend held between stops 3 and 4 (elderly condition *M* = 41.27, *SD* = 6.09 and young condition *M* = 44.02, *SD* = 5.46; *t*(21) = 2.30, *p* > .05, *r* = .25).

The segment between stops 4 and 5, however, did demonstrate a significant difference between elderly (*M* = 42.38, *SD* = 6.40) young *M* = 46.90, *SD* = 4.81); conditions (*t*(21) = 3.67, *p* < .05, *r* = .63). The segment between stops 5 and 6 showed a similar difference. In the elderly condition, participants drove slower (*M* = 47.36, *SD* = 5.42) than in the young (*M* = 48.83, *SD* = 4.65) condition (*t*(21) = 2.16, *p* < .05, *r* = .42). These results suggest that differences in velocity were not attained until after exposure to four street and sign voiced names.

As above, a mixed model ANOVA for mean velocity was measured starting after turn 1 and ending at turn 6 for all 22 participants, with sex and primary language as between group variables and name condition as the within group variable, revealed a main effect of name condition. Participants drove slower in the elderly (*M* = 44.42, *SD* = 4.68) condition than in the young (*M* = 46.65, *SD* = 4.17) condition (*F*(1, 18) = 12.18, *p* < .05, *r* = .64). No other comparisons were significant (*Table 5*).

In addition, a mixed model ANOVA examining the mean speed was conducted removing the same six participants and consisted with the previous mixed model ANOVA only condition (old or young) was significant (*F*(1, 15) = 7.45, *p* < .05, *r* = .64). No other effects reached significance.

Paired-samples t-tests were conducted for all 22 participants to compare the mean speed achieved in the young and old conditions between each pair of consecutive stop signs Data collection began after the first turn between stop sign one and two and ended once the sixth stop sign was reached prior to the final turn. Table 6 shows the means for elderly and young conditions. There were no differences between elderly ($M = 36.24$, $SD = 6.37$) and young ($M = 38.62$, $SD = 6.26$) conditions $t(21) = .72$, $p > .05$, $r = .15$ for the first segment, or second segments (elderly $M = 47.30$, $SD = 4.84$; young $M = 48.05$, $SD = 3.78$; $t(21) = .84$, $p > .05$, $r = .18$). There was, however, a significant effect from stop 3 to stop 4 with the elderly ($M = 40.44$, $SD = 6.04$) condition driving slower than the young ($M = 43.99$, $SD = 5.55$) condition ($t(21) = 2.30$, $p < .05$, $r = .44$). Similarly, there were significant differences ($t(21) = 3.55$, $p < .01$, $r = .61$) between elderly ($M = 43.04$, $SD = 6.51$) and young ($M = 46.62$, $SD = 5.13$) on the segment between turns 4 and 5. This trend held between turns 5 and 6; $t(21) = 2.2$, $p < .05$, $r = .43$. Participants drove slower in the elderly condition ($M = 45.72$, $SD = 4.11$) than in the young condition ($M = 47.28$, $SD = 5.37$).

These results suggest that the effects of priming were realized after the third stop sign and third directional instruction from the "Siri" navigational guide. Interestingly, this effect was demonstrated with mean speed (between turns 3 and 4) before it was demonstrated for maximum speed (between turns 4 and 5). Overall, behavior changes within both analyses took effect by the fourth stop.

The last question of the post-study questionnaire asked participants what they believed the experiment was about. Two participants correctly indicated that the study had something to do with names and driving, but neither noted driving speed as a variable of interest. Other various answers included emotions and driving, testing how easily people could stay in the roadway lines and follow directions, hand-eye coordination and safety of roadway conditions. This provides evidence that participants were largely unaware of the measures being taken during the either simulation.

General Discussion

This research further establishes the effects of priming in a simulated driving task. Using a neutral voice this experiment demonstrated that participants drove slower when hearing and seeing stereotypically older names than stereotypically younger names when maximum speed and average speed were measured. Further, the effect did not vary by sex, counterbalancing order or primary language spoken at home.

A turn-by-turn analysis showed that the priming did not take effect immediately, but instead required three voice navigation cues and turns to become present in the mean analyses and four voice navigational cues and turns to become present in the maximum analyses. This is not surprising, and replicates findings by Branaghan and Gray (2010) that required four priming cues for the driver behavior to noticeably change in their experiment. It is likely that the effects of priming are dose-dependent, requiring a certain amount of activation to build up before effects are realized and measureable.

Interestingly, these effects occurred even though participants were unaware of the purpose of the study. No participant indicated awareness that velocity was a factor in the analysis when asked in the post study survey. Though two participants determined that names played a factor in the experiment, neither determined that velocity was the measured variable of interest. This suggests that the participants were unaware of their personal behavioral changes throughout the simulation.

These findings are consistent with previous research (Bargh, et. al, 1996; Branaghan & Gray, 2010) that suggests unobtrusive priming may play a role in complex mental activities. However, there has been criticism from researchers unable to replicate the Bargh, Chen and Burrows results. A factor that may contribute to the success of results being replicated repeatedly in a driving simulator (Branghan & Gray, 2010; Taylor, 2010; Foster, 2012) is the high sensitivity measure of the driving simulator. Using a device that measures the participant's behavior directly allows for the behavior changes to be recorded rather than being dependent on a confederate to correctly time a participant. Additionally, in this simulation a participant heard a navigational cue and saw a street sign. The auditory and visual cue happening at the same time could provide a stronger manipulation, consistent with eliciting the priming behavior rather than one or the other. The Bargh, Chen and Burrows (1996) experiment only had a visual prime and it could be possible that the additional auditory cue is what has led to the repeated success in this experimental environment.

It is also, of particular interest is that this effect is seen in a fairly realistic situation. That is, the effect was achieved in a driving simulator, with a navigational system providing turn-by-turn directions. The use of a driving simulator was intended to test effects that could occur in the real world. On the other hand, several elements of realism were lacking and could affect results. All ambient traffic and speed limit signs were removed to eliminate the possibility of a participant gauging or trying to gauge their velocity. Also, no speedometer was included. This allowed a better testing platform for priming, but it did make the simulation less realistic.

Further, the driving simulator pedals are fixed to the floor, and a chair was used as the driver's seat so no appropriate adjustments could be made by participants to "better fit" the simulator. This could lead to driver performance that is different from the real world for a participant, but it allowed this experiment to maintain consistency among all participants.

Another limitation is that the participants were an average of 19.75 years old with an average 4.4 years of driving experience. The limited sample age and number of years of driver experience could prevent the participants from having the accrued knowledge of how to better gauge speed and drive appropriately in various conditions. The age, experience, and skill of a driver may be developed over time as experience is increased with accumulated hours of driving. This might lead to better recognition of the appropriate actions to take when driving in the real world. To better test the priming effect it could be beneficial to test a larger age sample to determine if these effects would be carried through various ages and generations.

In examining this priming research and real world drivers it could lead potentially lead to realizations that some signals in the real world do not elicit the intended or desired driver behavior. It is a common to see a sign "children at play" or "slow down" in areas with young populations. If when primed with something that is known as young a driver unconsciously changes their behavior to speed up that behavior would contradict the intended effect. In this experiment in the young condition, drivers drove significantly faster and in the old condition drove significantly slower. This potential for the opposite effect in real world conditions would need to be further examined in future research to determine if this in fact something that developing neighborhoods should consider when placing these signs and the driver behaviors that could result from them.

Future research could include an increase in the number of simulations and variety of primes. This research was limited to two conditions and using names as primes. Results showed that participants drove slower in the elderly condition. This may or may not generalize to the real world. This research did not look into whether or not reaction time, memory or sudden cognitive demands could have had negative implications for a participant primed with an elderly stereotype. There is research that reports that memory performance could be reduced with elderly primes (Bargh & Miedema, 2000). This research could further be developed with a memory task following an elderly or young prime to determine if that could affect the participant as well. Additionally, given the numerous research studies showing driving behavior to be influenced by age, gender, passengers, environment, etc., (Vollrath et. al., 2002; Conner et. al., 2003; Lin & Fearn, 2003) continuing research in cognitive and social psychology will lead to more discoveries that could lead to a better understanding of driver behavior.

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APPENDIX A

TABLES

Table 1. Study 1. Female Name Survey Results

Name	Mean	Standard Deviation	Total Responses
Agnes	8.55	1.63	20
Ashley	2.55	1.42	20
Blanche	7.2	1.01	20
Brittany	3.5	1.53	20
Gertrude	9	1.26	20
Harriet	6.4	1.62	20
Karla	5.05	1.52	20
Maude	8.4	2.15	20
Tiffany	2.5	1.63	20
Zoe	1.9	0.94	20

Table 2. Study 1. Male Name Survey Results.

Name	Mean	Standard Deviation	Total Responses
Alfred	8.55	1.73	20
Brandon	4.4	3.73	20
Cameron	4.7	3.8	20
Chase	1.9	1.04	20
Eugene	8.5	1.42	20
Harold	6.1	2.73	20
Hunter	2.8	2.91	20
Milton	8.9	1.88	20
Theodore	6.45	2.05	20
Travis	2.7	1.27	20

Table 3. Study 2. Maximum Velocity Mixed Model ANOVA

Test of Within Subject Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
conditionm	Sphericity Assumed	19.894	1	19.894	7.873	.012
	Greenhouse-Geisser	19.894	1.000	19.894	7.873	.012
conditionm* Gender	Sphericity Assumed	.013	1	.013	.005	.943
	Greenhouse-Geisser	.013	1.000	.013	.005	.943
conditionm* Language	Sphericity Assumed	8.314	2	4.157	1.645	.221
	Greenhouse-Geisser	8.314	2.000	4.157	1.645	.221
conditionm * Gender * Language	Sphericity Assumed	.000	0	.	.	.
	Greenhouse-Geisser	.000	.000	.	.	.
				.	.	.
				.	.	.
Error(conditionm)	Sphericity Assumed	45.481	18	2.527		
	Greenhouse-Geisser	45.481	18.000	2.527		

Table 4. Study 2. Maximum velocity between stop signs.

	Elderly		Young					
Stop Sign	Mean	SD	Mean	SD	t	effect size	95% CI Lower	95% CI Upper
Stop1 - Stop2	47.33	5.53	46.16	4.7	1.57	0.32	-0.42	2.77
Stop2 - Stop3	47.30	4.84	48.21	7.60	1.01	0.18	-0.97	2.80
Stop3 - Stop4	41.27	6.09	44.02	5.46	2.30	0.25	-1.32	4.78
Stop4 - Stop5*	42.38	6.40	46.90	4.81	3.67	0.63	2.08	7.53
Stop5 - Stop6*	47.36	5.42	48.83	4.65	2.16	0.42	0.07	3.64

*$p < .05$

Table 5. Study 2. Mean Velocity Mixed Model ANOVA

Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
conditiona	Sphericity.Assumed	44.585	1	44.585	12.178	.003
	GreenhouseGeisser	44.585	1.000	44.585	12.178	.003
conditiona * Gender	Sphericity Assumed	.060	1	.060	.016	.899
	GreenhouseGeisser	.060	1.000	.060	.016	.899
conditiona * Language	Sphericity Assumed	11.634	2	5.817	1.589	.232
	GreenhouseGeisser	11.634	2.000	5.817	1.589	.232
conditiona * Gender * Language	Sphericity Assumed	.000	0	.	.	.
	GreenhouseGeisser	.000	.000	.	.	.
Error(conditiona)	Sphericity Assumed	65.902	18	3.661		
	GreenhouseGeisser	65.902	18.000	3.661		

Table 6. Study 2. Mean velocity between stop signs.

	Elderly		Young					
Stop Sign	**Mean**	**SD**	**Mean**	**SD**	**t**	**effect size**	**95% CI Lower**	**95% CI Upper**
Stop1 - Stop2	36.24	6.37	38.62	6.26	.72	0.15	-2.59	5.33
Stop2 - Stop3	47.30	4.84	48.05	3.78	0.84	0.18	-1.08	2.56
Stop3 - Stop4*	40.44	6.03	43.99	5.56	2.30	0.44	0.34	6.76
Stop4 - Stop5*	43.03	6.51	46.61	5.13	3.54	0.61	1.48	5.69
Stop5 - Stop6*	45.72	4.11	47.28	5.37	2.2	0.43	0.09	3.03

*$p < .05$

APPENDIX B

FIGURES

Figure 1. Image of Driving Simulator.

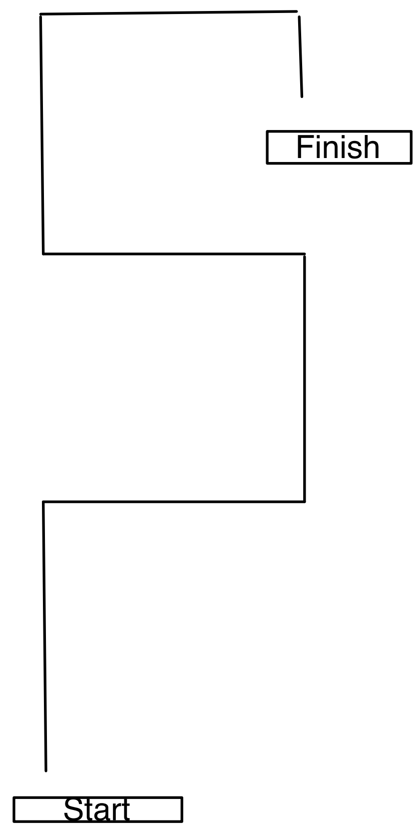

Figure 2. Top down view of route.

APPENDIX C

PARTICIPANT INSTRUCTIONS

Spring 2014

Dear Participants:

I am a graduate student under the guidance of Dr. Russell Branaghan in the College of Technology and Innovation at Arizona State University. I am conducting a research study to test the affects of driver performance.

I am inviting your participation, which will involve using a driving simulator to navigate through a city environment. You have the right to the end the study at any point in time. The study should require about 30 minutes to complete. After, completion of the study you will receive credit through the study pool.

Your participation in this study is voluntary. If you choose not to participate or withdraw from the study at any time, there will be no penalty, (for example, it will not affect your grade). You must be 18 or older to participate in the study.

There are no foreseeable risks or discomforts to your participation.

If you have any questions about the study feel free to contact Lisa Thew at lisa.thew@asu.edu or Dr. Russell Branaghan at Russ.Branaghan@asu.edu . If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788. Please let me know if you wish to be part of the study.

Experiment 2

Participant Instructions:

This study is composed of two different driving courses. Each simulated driving environment will take approximately 5 minutes to complete. You can ask questions at any time during the study (including while you are driving).

You will receive voice commands through the speakers indicating where to go throughout the simulation. If you are unsure of what was stated you can ask to have the direction repeated by the experimenter.

Please drive as you normally drive.

Please obey all traffic laws and signals.

If you miss a turn, the experimenter will guide you back on to the route.

The simulation will stop you automatically when it is complete.

There will be a total of 2 drives.

Please do not disclose the details of this study to others. This will help ensure consistent and accurate results.

Please let the experimenter know if you are willing to participate and understand the instructions.

Thank you for your participation!

Debriefing

Research has shown that exposure to different stimuli can affect driving speed. Research suggests exposure to words associated with the young and the old can change driving behavior in a simulated environment. Please let me know if you have any questions or feel free to email any follow up questions to lisa.thew@asu.edu

Thank you for your participation. The experiment is complete. Your credit will be granted within the next 24 hours.

APPENDIX D

PARTICIPANT POST SURVEY

PARTICIPANT POST SURVEY

1. How old are you?

2.) Gender (M/F)

3.) How fast do you think you drove on average (in miles per hour)?

4.) How many years of driving experience do you have?

5.) What is the primary language spoken at your home?

6.) What is your major?

7.) What do you think this experiment is about?